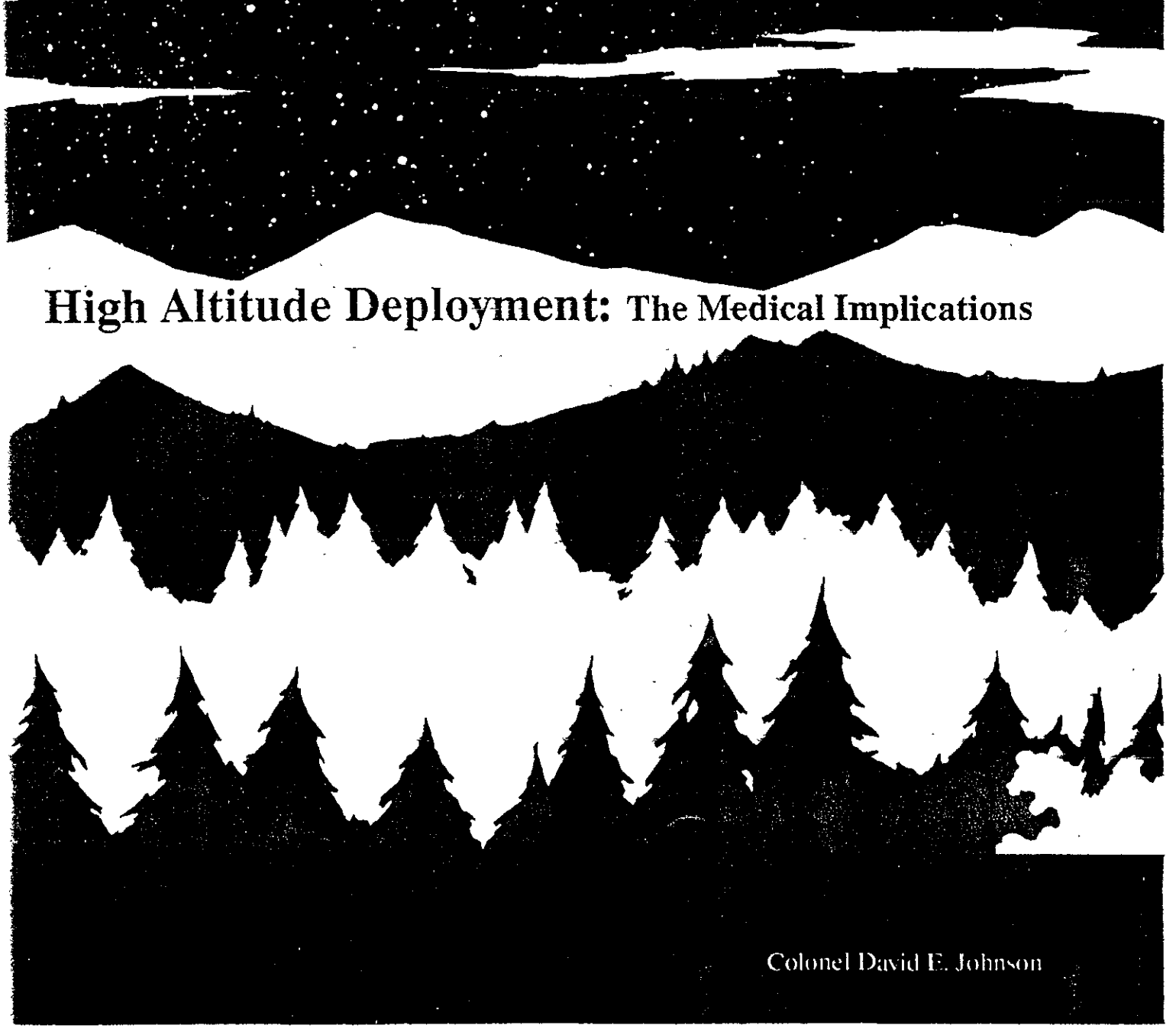

High Altitude Deployment: The Medical Implications

Colonel David E. Johnson

On 20 October 1962, military forces of the People's Republic of China assaulted defensive positions occupied by Republic of India forces at Thaga-La in the Himalayas and in a matter of hours totally overcame those defenses. As a result, India lost a great deal—territory of strategic value, manpower and equipment it could not afford to replace, its international position as putative leader of the non-aligned movement and, perhaps worst of all, the self-respect and self-confidence it needed to function smoothly as a democratic nation.

Many factors contributed to the defeat suffered by the Indian forces, including the Chinese Army's better logistics, perhaps better leadership and organization, and some level of superiority of numbers. Still, a significant portion of the blame must be laid on the fact that the Indian soldiers were not physically capable of performing their assigned mission.

To meet the Chinese threat, the government of India had dispatched to the mid-Himalayan frontier (4,000-4,500 meters in altitude) troops from the interior of the country who were not acclimated to high altitudes. Although these may well have been the only troops available, as events were to demonstrate, they were to suffer grievously for their unprepared state.

Unfortunately, what is medically known about the acute effects of a rapid ascent to high altitude is primarily confined to arcane medical journals and the memories of some specialists. But the ones who need this information most are military commanders, staff officers, and planners who are responsible for either ordering or conducting such deployments.

Nearly one-third of the world's land surface is dominated by mountains, especially in such disputed and volatile areas as Central America, South America, and south and central Asia. More than 125 separate mountains of 3,000 meters in

elevation and higher are located on every continent and in nearly any geographical sphere where the deployment of U.S. forces is conceivable. Many, if not most, international borders in these areas are remote and in dispute; even in cases where the exact lines are agreed upon, those borders are less than totally defensible.

The U.S. justly prides itself upon its rapid deployment and force projection capability. The Army's formation in recent years of new light divisions with world-wide missions indicates its current appreciation for a timely and credible U.S. presence at a potential point of disturbance.

In spite of these intentions, however, there are significant deterrents to the rapid deployment of U.S. forces to an area of high elevation. Not the least of these is the physical condition of the soldiers who would be sent into such an area.

In a rapid ascent to elevations above 3,000 meters, almost everyone is affected to some degree by the illness that has become known as "acute mountain sickness." Some individuals (estimates vary from 2 to 15 percent) will be severely affected, perhaps to the point of death; nearly all personnel will suffer a marked decrease in physical capability. A 60 percent reduction in work capacity is to be expected and this percentage may be even higher, depending on the elevation changes.

An Indian authority, speaking in 1967, had to admit, "Because of our commitments in the Himalayan terrain, troops are shuttled frequently between the sea level and 18,000 feet... In the last 5 years, over 2,000 [soldiers]... were incapacitated with the illness."

PHYSICAL CONDITIONING

Physical conditioning before ascent has no preventive value against the development of the illness. In many cases, young and energetic, but "heavily built" or perhaps overweight, soldiers appear to be the most susceptible to the life-threatening complications of acute mountain sickness.

Almost all individuals, at least temporarily, will have a headache severe enough to inhibit any level of sustained concentration. Reading, satisfactory marksmanship, or the "what if" type of deductive logic will prove difficult if not impossible. Shortness of breath, nausea, and dizziness will affect nearly everyone to some extent. Insomnia and nightmare-laden, frequently interrupted, short sleep periods are to be expected.

Short term memory will be severely degraded, a deficit that is especially critical in small unit leaders. Night vision capability will be markedly reduced and, in a few soldiers, the field of vision can be restricted. Loss of appetite and inadequate attention to thirst is routine. Leaders are no more immune to these effects than their subordinates.

The soldiers themselves are usually unaware of their decreased performance and altitude-induced deficiencies. Worst of all, leaders may be fully aware of their soldiers' limitations but remain fully convinced that they themselves are unaffected, thereby compounding an already difficult situation for the soldiers.

These symptoms begin about 6 to 48 hours after a unit arrives at high altitude and last from about four days to a week. Usually the symptoms will disappear in spite of anything the soldiers do or do not do, but during this period of time a unit will be largely ineffectual—and vulnerable.

For example, the Indian commander at the incident cited earlier noted, with chagrin, that before the battle "the efforts of our troops to cut logs with entrenching tools and shovels were pathetic and openly derided by the Chinese who could see us."

Only a few individuals will be capable of hard physical labor such as digging foxholes or clearing brush for fields of fire, and they will be slow in doing so. Both sustained heavy exertion and efforts that require sudden violent movement will be affected. Thus, patrolling will suffer from lack of attention to detail and also from lack of energy for prolonged efforts. Rapid maneuver will be difficult because the soldiers will be less efficient in loading and unloading equipment.

In contrast to the soldiers' reasonably rapid recovery from the symptoms of acute mountain sickness, however, its debilitating effect on their physical efforts will not soon, if ever, allow a return to lowland performance. Their ability to respond to a need for a sudden burst of strength will usually return in a matter of weeks, but a total sustained effort on their part may not return for years.

DISABILITY

During this period of disability, a unit commander's role must be primarily supportive. He must insure the availability of water and palatable, carbohydrate-rich food; he must encourage soldiers to drink and eat; and he must provide for the medical care they need.

He may have to closely regulate the consumption of alcoholic beverages, because alcohol will be metabolized more slowly during this period, and it may also cause a considerable loss of body heat.

He should let the soldiers know that he will limit the duration of the jobs that depend upon mental concentration, and that he will give them more time to complete tasks that require strenuous physical activities.

As the leaders will be undergoing this period of potential disability at the same time, some degree of external command and control (that is, from leaders who are not subject to the stress of acclimatization) should be considered for a period of two to three weeks following a unit's deployment.

A few individuals, for unknown reasons, will be particularly sensitive to the manifestations of "high altitude pulmonary edema," which may be life threatening. In addition to the symptoms noted above, some soldiers will develop a fluid build-up in the lungs (or, more rarely, in the brain) that is virtually untreatable except by a return to a lower altitude. Recovery is routine if the return is fast enough, but those individuals may subsequently develop a severe illness even during a gradual transition from lower to higher altitude. Accordingly, rapid ascent is presumed to predispose them to

a recurrence of the initial illness. Other predisposing factors include strenuous physical exertion, anxiety, and exposure to cold, the very factors they are most likely to face in combat.

Since returning the affected soldier to high altitude is likely to result in a repetition of the problem, the productive return of this soldier should not be expected. In fact, if he is evacuated, he should be considered lost to the unit.

Currently, there is no way to identify these sensitive individuals before deployment, except by their medical histories. According to a report from the Himalayas, one Indian medical officer "had to deal with an average of 30 to 40 new serious cases every day, and placed some 8 to 10 men on the 'dangerously ill' list. Almost all the cases were due to pulmonary oedema." This was out of a force smaller than most U.S. infantry brigades. In addition, when crisis decisions needed to be made, the senior officer the Indian government most depended upon to advise it regarding the conditions at the point of confrontation was in New Dehli disabled by the high altitude pulmonary edema he had acquired on the border.

The U.S. Army field manual on mountain operations (Field Manual 90-6) calls for troops to be acclimatized for operations above 2,500 meters. In the past, a wide range of measures have been tried to establish predeployment acclimatization and, thereby, to reduce the seriousness of acute mountain sickness. Most achieved only limited success, if any at all.

Over the past 20 years, much of the research has been aimed at finding a drug, or a combination of drugs, that will prevent the illness and allow a respectable level of troop performance at high altitudes. A common diuretic, furosemide (brand name, Lasix), has been used in India with only mixed results. (A diuretic is a drug that increases the excretion of fluid from the body. Urine output increases soon after taking the drug.) Another diuretic and anti-seizure medication, acetazolimide (brand name, Diamox), has been shown in U.S. studies to have limited value. At best, diuretics can be expected to reduce the symptoms of acute mountain sickness by 20 percent or less, and the resulting dehydration makes the drugs potentially self-defeating.

Morphine and codeine have been tried with some benefit, but again, the usefulness of soldiers who are treated with these drugs must be weighed against their usefulness if they are not treated. Steroids have been used to try to prevent acute mountain sickness, and if the Indian deployment in the Himalayas occurred today most (but not all) experts would recommend giving the soldiers a combination of steroids and acetazolimide before they moved to the higher altitudes. At best, though, this would be effective in less than half of the soldiers deployed.

In addition, since neither of these drugs is totally benign, they would have to be prescribed on an individual basis. Most of the conditions for which the drugs would not be prescribed—such as kidney or liver disease—are usually not present in a young and healthy military population. Nearly all soldiers, therefore, should eventually be able to take the regimen. Nevertheless, it would be necessary to check for those rare conditions, and this would be time consuming. For the foreseeable future, then, predeployment treatment offers little relief from the problems a unit can expect to encounter if it is deployed rapidly to high elevations.

To get troops to a high battlefield, the Army will have to acclimatize them in one of two ways: Station soldiers at high elevations for long periods so that they become acclimatized in anticipation of deployment (for example, large forces of the Chinese Army had been stationed in Tibet for years before the war with India), or deploy units through a series of stages at progressively higher elevations.

Currently, the U.S. has no cadre of acclimatized troops, and it has no installations at high elevations at which a significant number of combat troops can be positioned for long periods of time. Fort Carson, Colorado, at an approximate elevation of 1,900 meters, is the best that is presently available, and the soldiers assigned there can be expected to have a marginally increased heart and lung efficiency. But that elevation is still too low for them to become acclimatized to higher altitudes. Smaller numbers of troops can be maintained on facilities at Pikes Peak, Colorado (4,300 meters), Mauna Loa, Hawaii (4,170 meters), or Pickle Meadow, California (2,079 meters). Unfortunately, these are not large enough to hold a significant number of soldiers; they could be used as staging areas, however, along with certain of the mountain resort communities in New England and the western United States.

Acclimatization through progressive stages would require a scheduled stop at an intermediate altitude of about 2,400 meters before going above 3,000 meters and subsequent layovers every 600 to 900 meters after that before arriving at the desired deployment site, with at least a two-day stopover at each stage. In other words, the deployment to the site of the Indian-Chinese battle at Thaga-La (approximately 4,400 meters) would require at least eight days with intermediate stops at 2,400, 3,000, and 3,700 meters.

Other authors have suggested longer stops at less frequent intervals or smaller incremental steps, but in all cases a significant lag is necessary between the beginning of the deployment and the commitment of troops into combat. Simply loading troops on aircraft at Fort Bragg, for example, and off-loading them in the theater of operations with the expectation of immediate employment is not feasible. The location of staging areas is critical, and suitable staging facilities should be a condition of the acceptance of any invitation from a host nation.

Ideally (and necessarily if altitudes greater than 4,500 meters are expected), staging should be accomplished as close to the site of operations as possible. During this staging period, the time can be used for equipment checks, final training, and last-minute briefings, but it should not be used for strenuous physical activity or exertion. Similarly, troops should not be committed to active operations immediately after they arrive at the final deployment site.

Early in such deployments, more medical and evacuation personnel and equipment need to be included to treat the inevitable illnesses and to quickly spot soldiers who cannot tolerate extreme elevations. Under no circumstances should leaders expect standard lowland performance from their soldiers.

By paying attention to eating and drinking requirements, early deployment drug treatment, and especially the rate at which the soldiers are moved from a lower elevation to a higher one, a commander can reduce the acute effects of mountain sickness. Nevertheless, he must take into consideration the significant decrease that will take place in the ability of his soldiers to fight.

One of the men who recorded the Indo-Chinese conflict wrote:

Some officers and men who were rushed to the Dhola area succumbed to the hazards of the mountains (as opposed to the fighting itself), fell ill, and took no further part in the proceedings. It is foolish to ignore the problems of living in the mountains, at heights above 9,000 feet. In this respect we must emulate the Monpas [a local Himalayan tribe] who move slowly, rest frequently, and undertake short daily stages. Over the centuries they have developed the physique and lungs for surviving in the Himalayas. Commanders who later ordered forced marches, day after day, and who otherwise drove troops beyond human endurance, only courted disaster.

This report may be the best possible summation of the medical military aspects of high altitude operations.

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